RESOLUTION NO. 49-96

A RESOLUTION ADOPTING CITY OF GRAND JUNCTION WATER CONSERVATION PLAN

Recitals:

Under the provisions of Colorado law within five years of June 4, 1991 each municipality, agency and utility, including any privately owned utility, or other publicly owned entity with a legal obligation to supply, distribute or otherwise provide domestic, commercial, industrial or public facility customers with water at retail and which has a total demand of two thousand acre feet or more of water each year shall prepare, adopt and implement a water use efficiency plan.

The water use efficiency plan shall be publicly available and considered and after due consideration shall be implemented to encourage efficient water use.

The manner in which the water provider develops, adopts, makes publicly available and implements the plan is discretionary so long as the plan considers certain water saving measures including but not limited to water efficient fixtures and appliances, low water use landscape and efficient irrigation, water reuse, distribution system leak repair, public education and dissemination of information regarding water saving and efficiency. The plan must also provide a program for implementation and must contain a statement concerning the role of water use efficiency in the water providers supply, delivery and planning.

The City of Grand Junction as a covered water provider has prepared a *Water Conservation Master Plan* pursuant to and consistent with the requirements of Colorado law. The Plan has been developed, adopted and made publicly available, includes a program for its implementation and otherwise meets the criteria of the Colorado Water Conservation Board.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF GRAND JUNCTION THAT:

The *Water Conservation Master Plan* is adopted as the official policy of the City of Grand Junction and by its adoption the City does encourage its customers to use water efficiently as detailed in the plan and otherwise.

Adopted this 15th day of May, 1996.

/s/ Linda Afman
Linda Afman, Mayor

Attest:
/s/ Stephanie Nye
Stephanie Nye, City Clerk

WATER CONSERVATION MASTER PLAN

CITY OF GRAND JUNCTION

Approved by Resolution of City Council , May ___, 1996
Submitted To Office Water Conservation, June 4, 1996
Department of Natural Resources
State of Colorado

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Preface ...

This Conservation Master Plan was developed to provide a policy and a guideline for future conservation activities for the City of Grand Junction water service area. The Conservation Plan has a set of goals that either maintain or reduce water uses. The plan also describes, in general terms, methods to reach each goal. It establishes the criteria by which specific conservation measures will be selected as well as a process for measuring results. The glossary at the back of the document defines terms which may need clarification and/or context for this Master Plan.

In this document, water conservation is defined as eliminating water waste and making beneficial water uses more efficient. This includes but is not limited to efficient use of financial resources dedicated to providing water to the people of Grand Junction. Conservation does not mean deprivation or preservation. Rather, the term encompasses the voluntary choices people make about water to ensure a sustainable future.

This plan is to be carried out through Annual Conservation Action Plans. Each Action Plan will list specific measures or programs to be implemented each year along with the associated costs, responsibilities and target goals. Action Plans will also include an evaluation of the previous year's plan -- what worked and what didn't, what goals were met, what needs to be changed, and other relevant information. A summary of the current Annual Plan will be available upon request from the Utility Managers Office, 250 N. 5th. Street, Grand Junction, Colorado, 81501, by December of each year.

The Conservation Master Plan is an ever-evolving document. As new ideas are developed which meet the criteria, they will be added. Existing ideas that have been fully implemented or are deemed no longer viable will be deleted. The entire Master Plan will be re-evaluated

every five years. Major changes to the Master Plan shall be provided to the public in draft form and opportunity to comment on such changes shall also be provided, before adoption of such changes.

This Conservation Master Plan was cooperatively developed by the following water utilities serving the Greater Grand Valley Area in Mesa County. However, each water provider has a specific plan to meet their own needs. The water providers are: The City of Grand Junction, Clifton Water District, and Ute Water Conservancy District.

About Water Conservation

What it is ...

Water conservation is the utilization of a set of strategies which will enable us to utilize our essential water resources in a wise and prudent manner, both through supply management, in which the City of Grand Junction maximizes the efficient delivery treatment and use of water, and through demand management in which the customer practices the efficient use of this resource.

What it's not ...

Water conservation is not a matter of reducing water use without limit. Nor is it meant to deprive our community of the benefits for which it was intended, including the essential benefits of health, nutrition, and the appealing environment we all enjoy.

What is its purpose ...

The purpose of this water conservation plan is to provide those benefits as efficiently as practicable given current knowledge, state of technology, and prudent cost considerations.

Who benefits ...

Water that remains in our streams and reservoirs provides many benefits which are important to our customers and our community. When water is used efficiently, more water can remain for recreation, wetlands, dilution, natural aesthetics, and habitat for fish and other wildlife. Customers benefit by extending supplies, protecting the environment, and the wise use of their money.

What it costs ...

Water conservation is not free and may not always be cheap. When customers use less water, City of Grand Junction's costs do not decrease proportionally. On the other hand, conservation defers the need for supply expansion, thereby deferring some water rate increases. In any case, since not everyone conserves at the same rate, those who conserve will definitely save more money than those who do not.

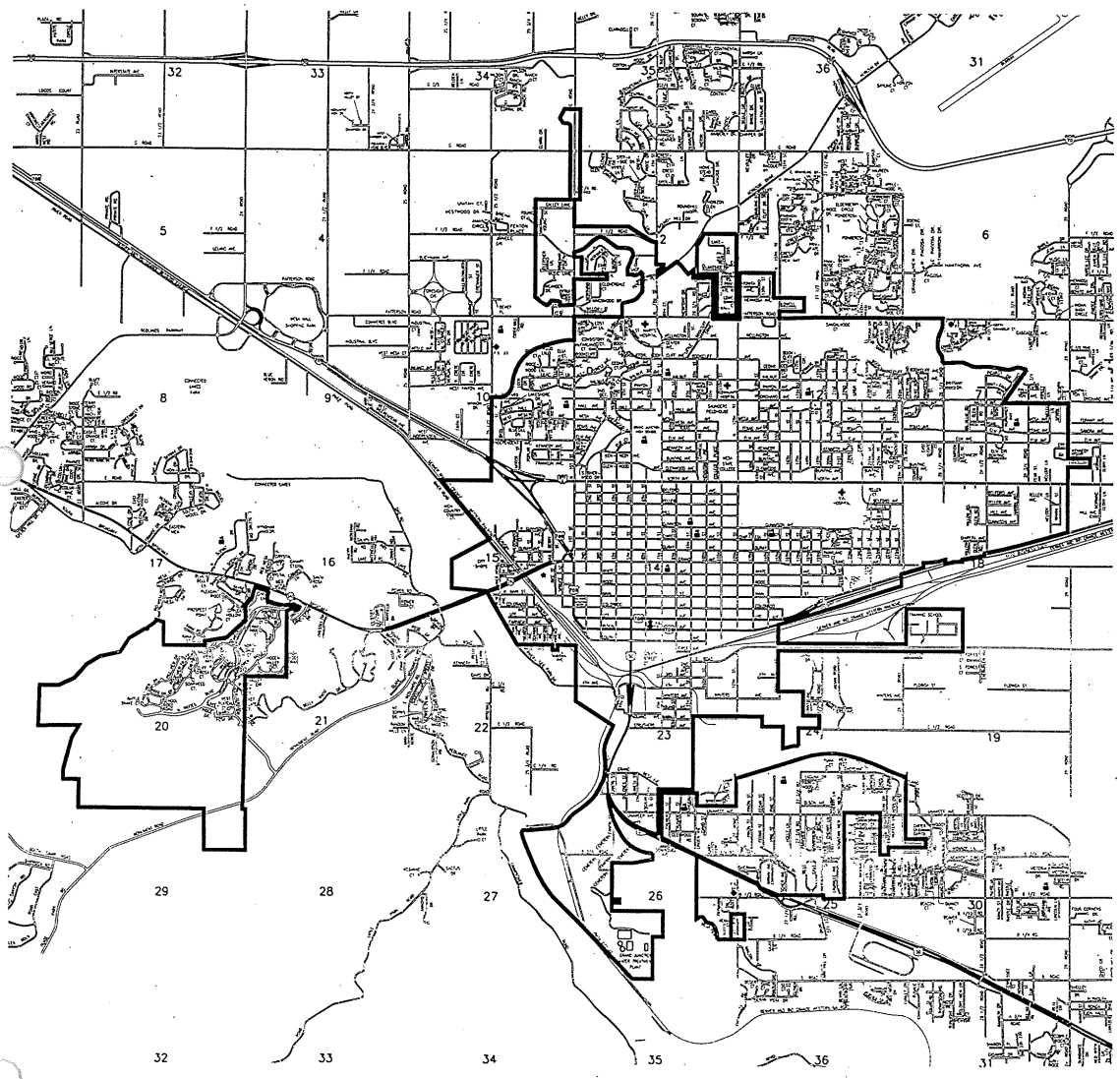
Who is responsible ...

Water conservation is a duty of City of Grand Junction, and many of the programs contained in this plan -- leak detection, billing information, education programs -- place the accountability on the City. Yet much of the potential savings must come from the actions and habits of our water customers. Water conservation is many small actions that add up to a big difference. It makes sense and saves cents.

TO PROMOTE WATER CONSERVATION BY EXAMPLE, EDUCATION, AND INNOVATION, WHEN IT IS NOT INTRUSIVE UPON COMMONLY ACCEPTED LIFESTYLES OR MAINTENANCE OF A PLEASING ENVIRONMENT. CONSERVATION MAY ALSO BE ACHIEVED BY MANDATORY MEASURES IN TIMES OF EMERGENCIES.

(Mission Statement)

CITY OF GRAND JUNCTION
WATER SYSTEM



INTRODUCTION

History of City of Grand Junction Water System

When Grand Junction was founded in 1881, who would have thought that with two major rivers running through it's back yard, water would become a major issue.

The development of a water supply for the City of Grand Junction was much the same as the general trend nationwide, of first being supplied, under contract, from a privately owned water company (Krusen Water Company), with a direct river source.

The first water supplied to the residents of Grand Junction in 1889 was from the Colorado River via a pumping plant located at what is currently the Fifth Street bridge. This water was not of very high quality due to being muddy in the spring and during rain storms.

In 1889, because of the poor Colorado River water quality, the City went away from the Krusen Water Company and built their own pump station on the Gunnison River, which was thought to be a better quality of water. This pump station pumped water up to a small reservoir located on "Reservoir Hill" above the present day city cemeteries. This is the present site of water treatment plant. At the same time a new distribution system was being constructed in town to take advantage of this new source.

By 1905, however, the Town residents were again complaining about water quality. The community began a search for a higher quality water and eventually settled on the Kannah Creek area of Grand Mesa. "Water...at any price" was the direction given to the city by its residents and in Kannah Creek a quality mountain source was found.

In 1907, the effort was started to acquire the first priority water right for 300 "inches", or 7.81 cubic feet per second of flow

from Kannah Creek. In 1911, the City, after condemnation proceedings, was granted this paramount water right but was ordered to pay a sum of $189,932.26 to area ranchers, as a settlement in the case.

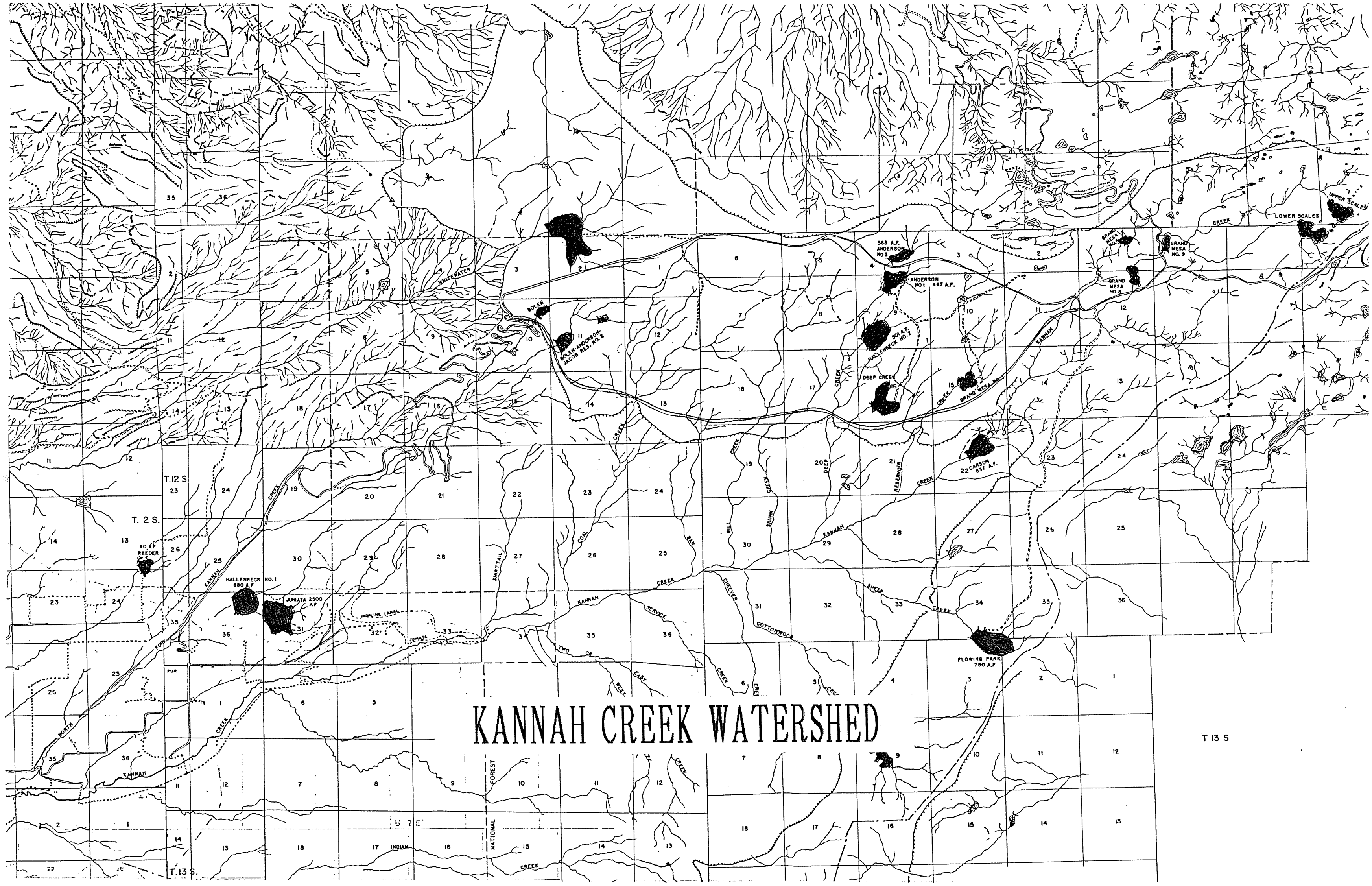
Also in 1911, construction was started on the first flowline that would bring this new water source to town, some twenty miles away. In 1912, this newly constructed line of wood and steel started delivering up to 5 million gallons per day to the citizens of Grand Junction.

Around 1938 the City built it's first water treatment plant, on Reservoir Hill, that would treat up to 5 million gallons per day. This plant was expanded to treat 7.13 million gallons per day in 1946.

Needing to expand and reinforce it's mountain water supply the City constructed Carson Reservoir in the Kannah Creek area in 1947 to hold 650 acre feet of water.

In 1955, the City acquired water and land rights from Mr. Hallenbeck and Mr. Anderson. This gave the City water rights in the Hallenbeck #1 Reservoir (now Purdy Mesa), Juniata Reservoir and Reeder Reservoir, reservoirs on Grand Mesa, and direct flow water rights to fill all. With these acquisitions the City formulated plans to build a second flowline to town. This line was of wrapped steel and increased capacity to deliver water to town to 12.5 million gallons per day.

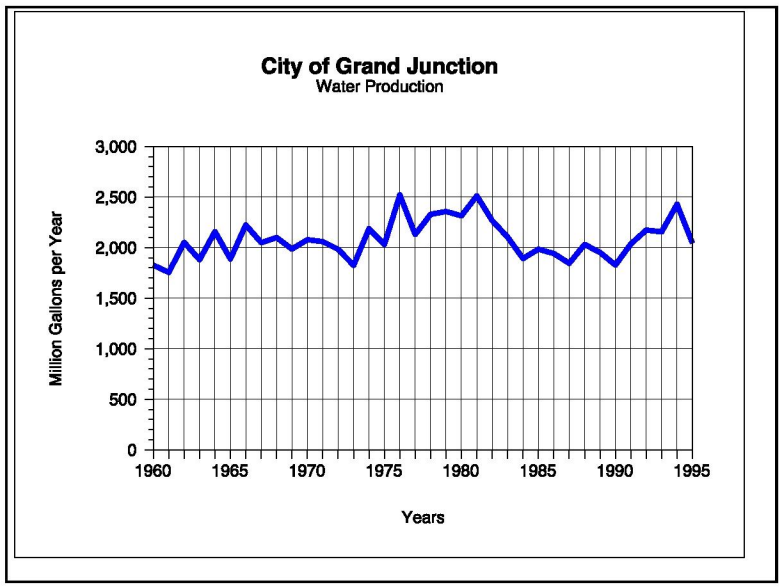
As the City grew, so did the need for additional water. In 1957, the City acquired direct flow water rights in the Gunnison River for 120 cubic feet per second. A few years later the City added additional water rights in Raber Click and Juniata Reservoirs. Along with these rights came additional direct flow rights. The City constructed a new pump station on the Gunnison River in 1972 to use it's Gunnison river water right. At this time the City also acquired Colorado River water rights of 120 cubic feet per second with an appropriation date of 1947.


KANNAH CREEK WATERSHED
T.12 S
T. 2 S.
T.13 S.
T 13 S
HALLENBECK NO.1
680 A.F
FLOWING PARK
780 A.F.
LOWER SCALES
UPPER SCALES

During the late 1960's a new water treatment plant was constructed to treat up to 16 million gallons per day of water. This is the same plant that is still in service today providing customers high quality treated water.

A major drought swept through the area in 1976/77 that caused City planners to come up with some new ways to avoid future water shortages. During the next couple of years, the City helped the Clifton Water District construct a new treatment plant on the Colorado River capable of treating 8 million gallons per day. With this construction, the City was assured that up to 4 million gallons per day would be available for City water customers if it were needed. The City enlarged Juniata Reservoir to hold a years supply of water, along with enlarging the pumping capabilities on the Gunnison river.

In 1989, the City took a major step by purchasing the Somerville ranch and associated water rights. These rights, added to other high quality mountain water rights, would insure that the City of Grand Junction would have enough water to satisfy it's customers during the severest drought.



Currently the City serves around 9,000 active taps and a population of 25,000+, But because of improved irrigation practices, advancement in plumbing fixtures, change-over of the cemeteries and the Lincoln Park golf course to an untreated water source and public awareness of water use, the City currently produces

and consumes, on the average, the same amount of water it did thirty years ago. The graph represents water production through the treatment plant and shows the effects of both wet and dry years.

PURPOSE

The primary purpose of the City of Grand Junction's Water Conservation Master Plan is to promote the efficient use of water during times of plenty and to ensure a smooth transition to a reduction in demand during times of scarcity and drought.

Historically, the philosophy of the City of Grand Junction has not discouraged the use of domestic water for residential irrigation purposes.

CONSERVATION GOALS

The goals for City of Grand Junction's water conservation program are:

- Promote awareness, through education, that the Grand Valley is situated at the edge of the upper Sonoran Desert life zone and, as such, could be seriously affected by long-term drought conditions in the future, as in the past.
- Encourage wise use of water for ordinary household uses and for outdoor irrigation to a reasonable degree to insure a green and pleasant outdoor environment.
- Plan for times of scarcity to insure minimum disruption and a smooth transition to reduced consumption.
- By wise and selective use of water for specific functions, preserve capacity in City's physical facilities, postponing costly plant/facility enlargements.
- Accommodate an awareness that water resources are available or ought to be available for preservation of habitat, in-

stream flows for recreation or aesthetic purposes, and for use by aquatic and terrestrial wildlife.

CONSERVATION POLICIES

Water conservation will be an integral part of water management planning for the City of Grand Junction. The value of water conservation as a component of supply or demand reduction will be evaluated on the same economic basis as the development of any other water supply.

The legal and institutional conditions that may affect water use or have an impact on the conservation program will be assessed. The following factors will be considered in developing, implementing, and evaluating Grand Junction's water conservation program:

- Federal agency programs and activities; federal legislation;
- State statutes and administrative procedures for regulation of water supply and water use, including water rights laws, administrative regulations and procedures, environmental permits, water and energy programs, and building and plumbing codes; state legislation;
- Interstate compacts, court decrees, local water agreements;
- City ordinances or resolutions, agreements, and programs, including current efforts to reduce waste of water, rate structures and policies, land use planning, and building and plumbing codes.

The potential benefits and problems associated with increasing water use efficiency will be considered in developing, implementing and evaluating the City of Grand Junction's water conservation program.

Water Conservation Benefits

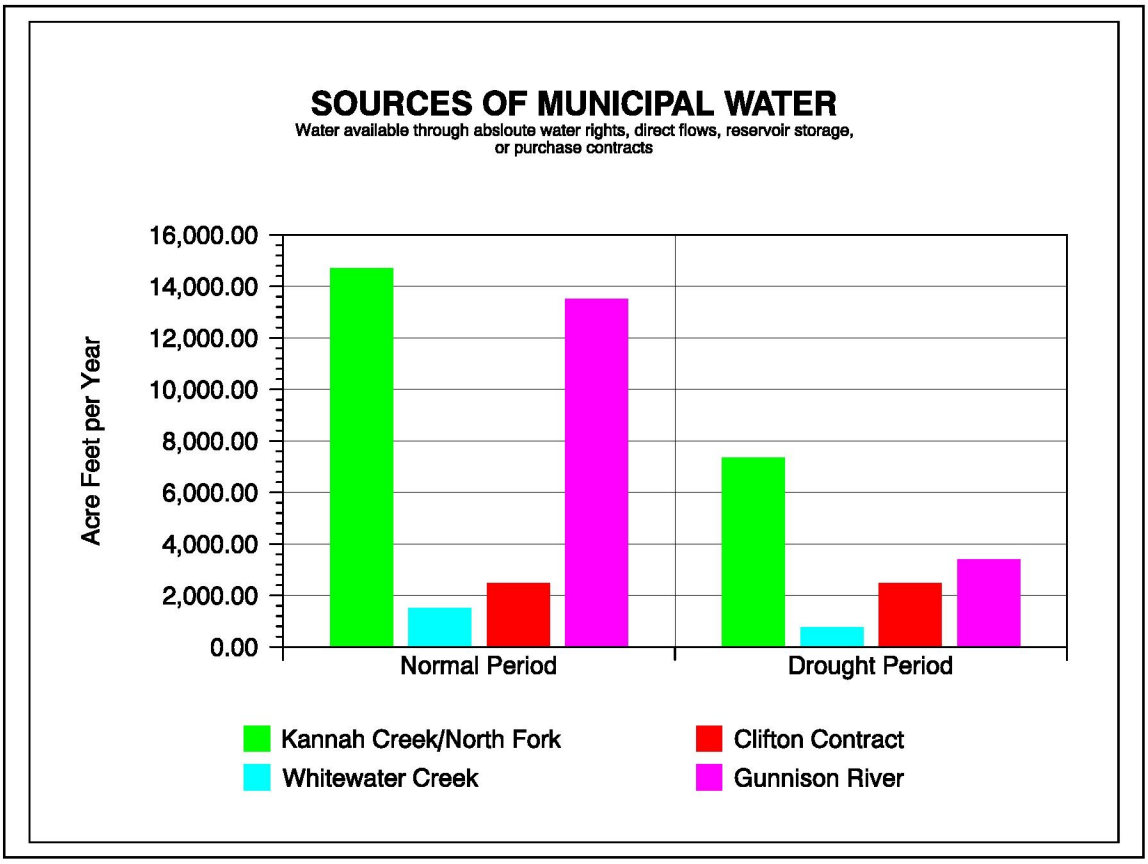
- Reduced demand of water can extend existing water supplies.
- Energy savings by cutting hot water use in a home.
- Protection of the environment by diverting less water from streams, lakes and reservoirs.
- Reduced utility costs because reduced capital improvement expenditures, which may lead to reduced water rates.

Water Conservation Problems

- Reduced water revenues due to reduced water sales.
- Delay in construction of needed water supply projects is usually a favorable effect unless inflation increases the construction costs, affecting the utility's future ability to fund needed projects.
- Increasing water use efficiency under normal conditions may make additional savings during a drought or emergency more difficult to achieve.

AVAILABLE WATER SUPPLIES

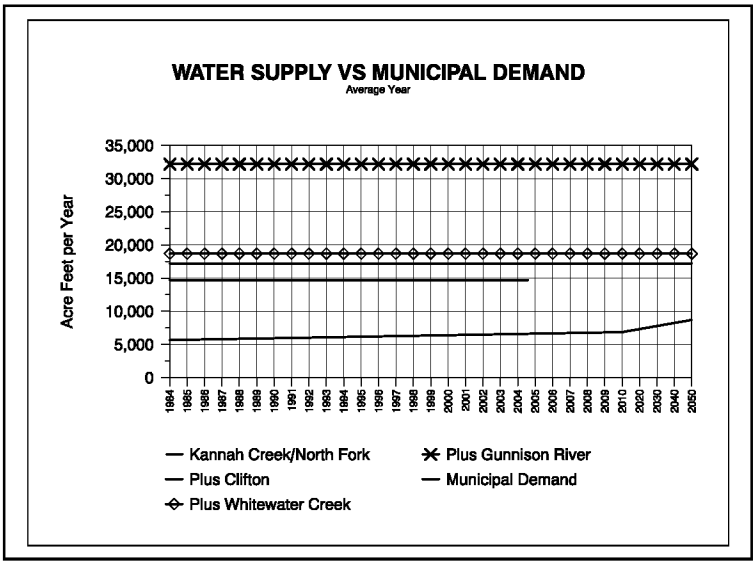
The City of Grand Junction has always tried to maintain an adequate, high quality, water supply for its customers. During the last 40 years, the City has acquired numerous water rights in reservoirs, lakes and streams.

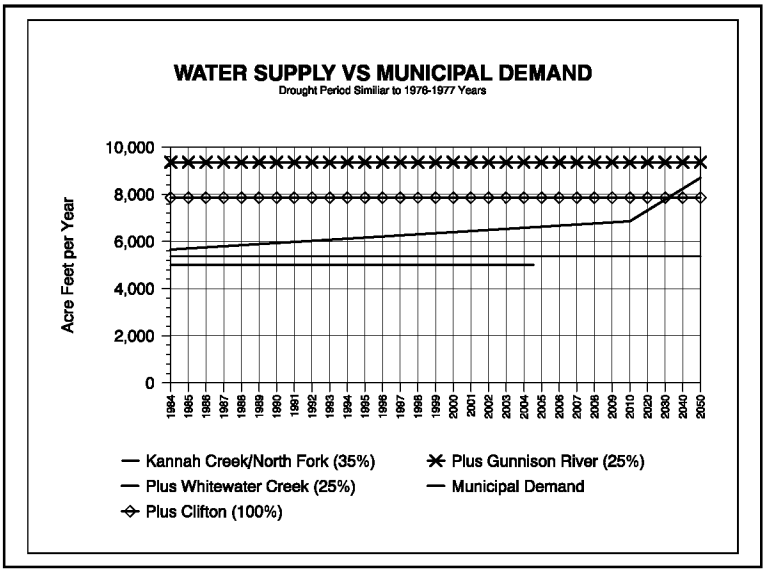


The above graph shows only absolute water rights and does not include conditional water rights on the Colorado and Gunnison rivers. The City's Colorado River water right is shown in part, through the Clifton Contract.

Based on projected trend analysis of future water demand and estimates of water resources available during a drought, the City will have enough water to satisfy its customers. Growth within the City of Grand Junction water system has been minimal over the last few decades

and available infill is limited. The City's water system is surrounded by the Ute Water Conservancy District and expansion of our water service area is limited. Recent discussions about potential exchanges of water customers in certain areas would have little impact on overall water demand on City's system.

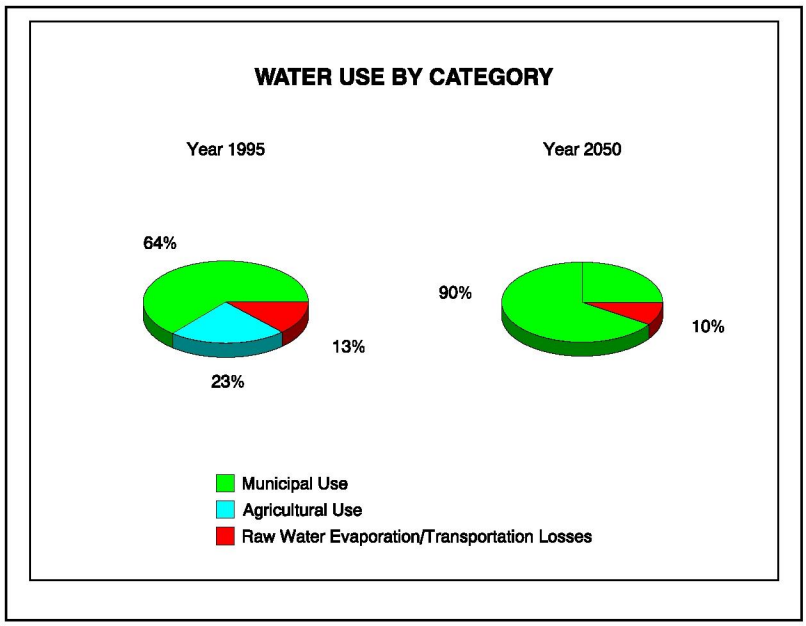


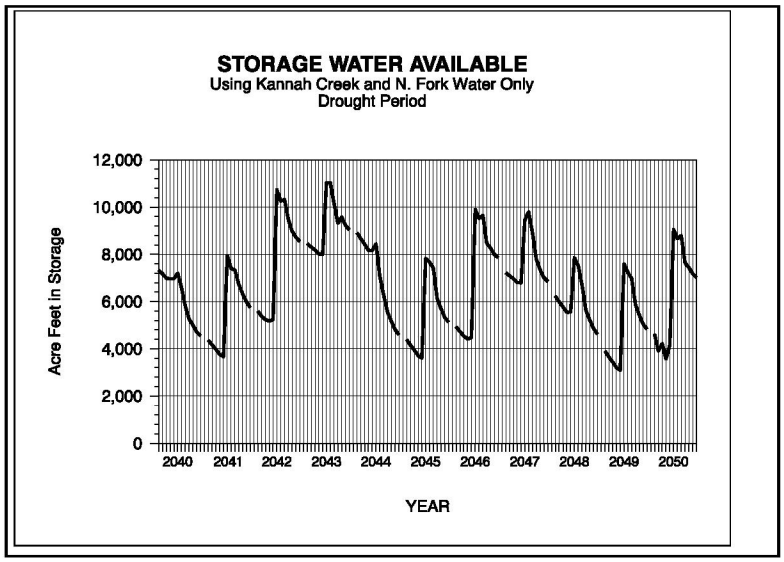


The graphics show "WATER SUPPLY VS MUNICIPAL DEMAND" in an average year and a drought period similar to either 1976-1977 or a 1989-1990 water year. Using regression analysis and data from 1984 through 1995, the graphs project usage into the year 2050. Based on this data, our projected demand increases 0.529% per year for the next 55 years. The graphs show yearly projections up to year 2010, years 2010 through 2050 are shown in ten years increments to show future years demand.

The amount of water available for use by the City will vary according to the weather. Estimated annual average yields from the City's absolute water rights, based on historical flows and diversion records from streams, lakes and rivers, shows the City has available

for use, 32,200+ acre feet of water. Of this amount, 16,200 acre feet is available from the Kannah Creek, North Fork of Kannah Creek and Whitewater Creek drainage, 2,485 acre feet is available through contract with the Clifton Water District via Colorado River and 13,000+ acre feet is available on Gunnison River. The amount of water available should not dramatically change in the next fifty years but where and how the water is used, will change. In 1995, 23 percent of available water in Kannah Creek and North Fork of Kannah Creek basins was being used for agricultural purposes. In the year 2050, this percentage will drop to zero to fulfill needed municipal demands. Based on records during the drought periods of 1976-1977 and 1989-1990, projections of available water supplies can be conservatively estimated. The City's Paramount water right on Kannah Creek will produce 75% of needed municipal water for City water customers in year 2050. The remaining 25% of needed water will come from other direct flow rights available or if needed from carry over

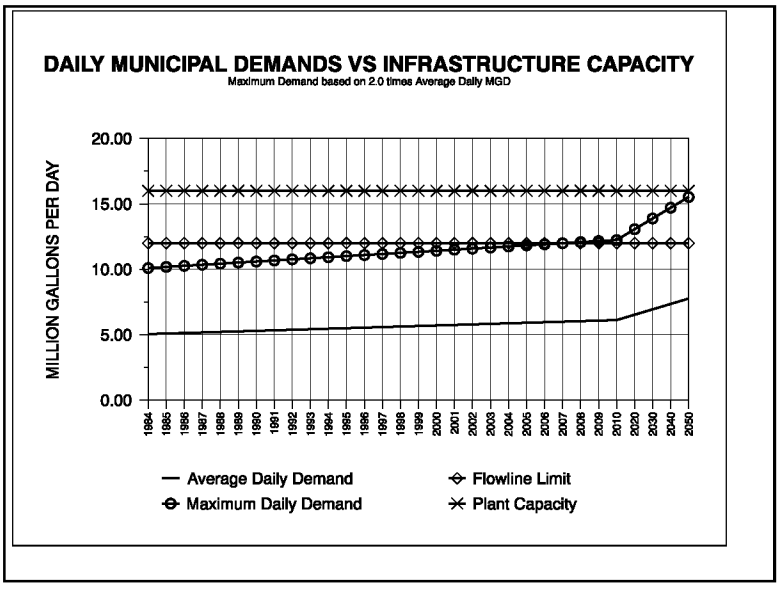




reservoir storage.

The City has developed and maintained databases and records to project available storage on an annual basis and to try to predict available storage during times of drought. The graphic shows amount of storage water that should be available from 2040 through 2050 using drought period data. These databases and records will continuously be modified and updated to more correctly predict available water resources.

Based on projected water demand supplied by City of Grand Junction municipal water system, which includes sales to other water districts, major expenditures for infrastructure, such as additional treatment plant capacity or additional raw water flowline capacity should not need to occur before year 2050. The existing treatment plant and raw water flowlines will need to be replaced, more because of age, and not necessarily because of lack of capacity. The treatment plant will be 80 years old in the year 2050 and the flowlines almost 100 years old. The maximum daily demand for treated water is based on two times average daily demand for treated water into municipal system. The demand exceeds the capacity of the flowline but is made up with raw water storage located at treatment facility. This raw water storage will supply enough raw water to the treatment plant to meet all maximum daily demands above flowline capacity for a period of six days. Most time



durations that exceed flowline capacity are within this six day time frame.

WATER CONSERVATION AND WHERE WE ARE TODAY

ACCOMPLISHMENTS AND CURRENT PROGRAMS:

Information and Outreach

Currently the City has a bimonthly newsletter that is sent to all citizens. This newsletter is used to inform the citizens of Grand Junction changes the City is planning, such as parks development, land and water use decisions, annexation policies, water conservation, up-coming programs or just general "what's happening".

City personnel are available to address various civic and service organizations, as well as school classes.

Education and Training

The City offers school programs, including tours of the water treatment plant, to teachers and students in addition to our customers. These tours are a vital link to help adults and children understand the importance of conservation in their lives and the relationship of water supply and the protection of that water supply.

Teacher training workshops for recertification credits are available in cooperation with the Colorado Water Conservation Board.

Ute Water's Annual Childrens Water Festival is a major activity in which conservation plays a large role. The annual average attendance is 1,500 fifth grade students, plus teachers, during the day-long event. City of Grand Junction, and Clifton Water District participate and contribute to this event. The 1996 event will include an evening event for adults to attend and participate in festival.

Metering

The City of Grand Junction is committed in its effort to provide an accurate measurement and record of water use as an aid to promote Water Conservation. Metering is used to make a customer more aware of how much water they are using. The Water Department has maintained an active metering program since its inception.

The City has over 99% of its customers metered. The customers not metered are Lincoln Park, which is scheduled to become 100% metered by 1997, the downtown shopping park, and numerous median strips around the City. The City has an ongoing program of meter repair, replacement and recalibration. Residential meters are presently being replaced under a program that will see the whole system changed out within six years. The larger meters of 1 1/2" and greater will be completely retrofitted to externally read meters (AMR's) by end of 1997. These meters will be retested a minimum of once every five years.

The City's water department reads all water meters monthly and sends bills to customers approximately 20 days later.

1. The City's water department meters over 99% of the system's services. These meters are read by City's meter readers.

2. The approximate current number of active accounts in the system is 8,500.

3. The City currently utilizes two types of meters. On all meter installations, 1 1/2" and larger, an externally read meter (AMR) is used. On all residential and commercial meters, 1" and smaller, a direct read meter is used.

4. The current program utilized by the City is to monitor, repair or replace meters based on manufacturer's recommendations and as follows:

a. Suspect readings are flagged by computerized

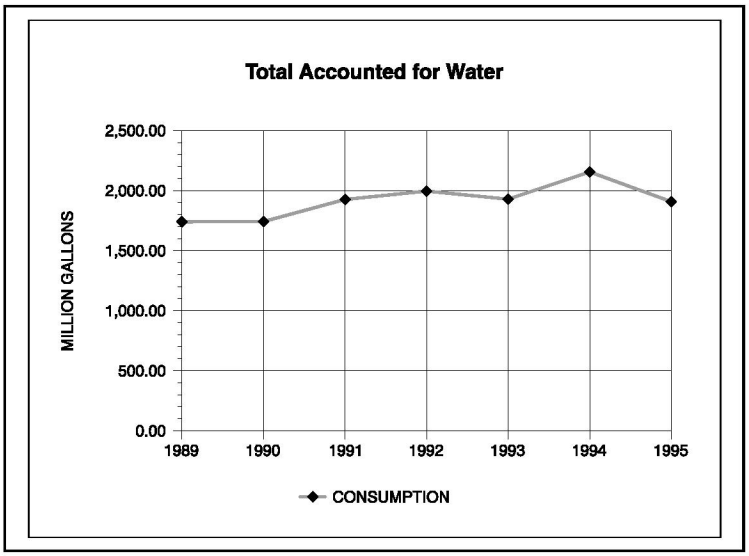
billing system.

b. A physical inspection of these locations takes place.

c. The meter is pulled and tested to assess its operation.

d. The meter is replaced, if necessary.

5. The only reference available for the City of Grand Junction to compare the effects of its current metering program is to look at annual water consumption figures from the past. The records from previous years indicate that growth rate for customers in the City's water system is fairly flat at 0.529% annually. A similar trend can be noted for consumption for past years. A decrease in "unaccounted-for" water in 1995 is due to large meter replacement program.



6. The current expenditures for the City of Grand Junction's metering program are approximately as follows:

a. Meter Reading 2.0% of Annual Budget

b. Meter Repair/Installation 1.4% of Annual Budget

c. Meter Purchases 1.1% of Annual Budget

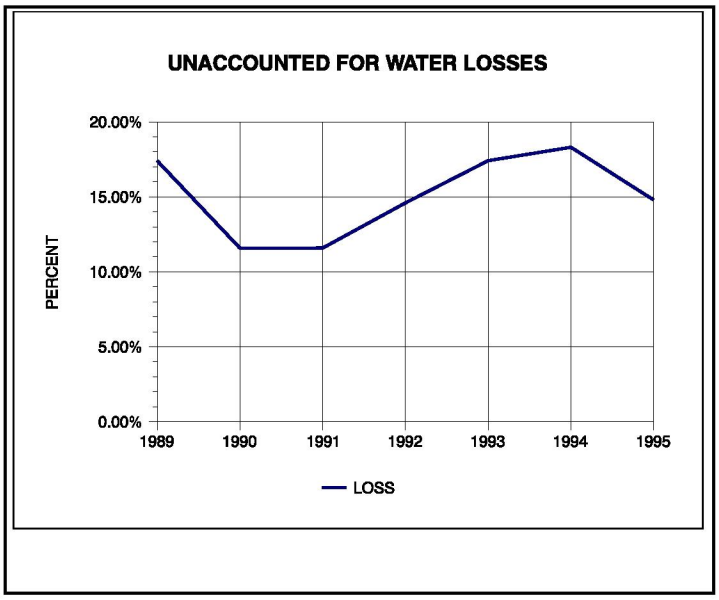
7. The long range goals that the City has for improving the metering program are as follows:

a. 100% installation of 1 1/2" and larger meters by

end of 1997 with externally read meters(AMR).

end of 1997 with externally read meters (AMR).

b. 100% installation of 1" and smaller meters by year 2001 with direct read meters.



c. 100% installation of 1" and smaller with external read meters (AMR) on all accounts that require more time than normal to access a reading. This includes meters in basements, meter pits that require pumping monthly, etc.

d. Confined entry meter pit installations are almost eliminated. This reduces safety hazards and generates more accurate meter readings.

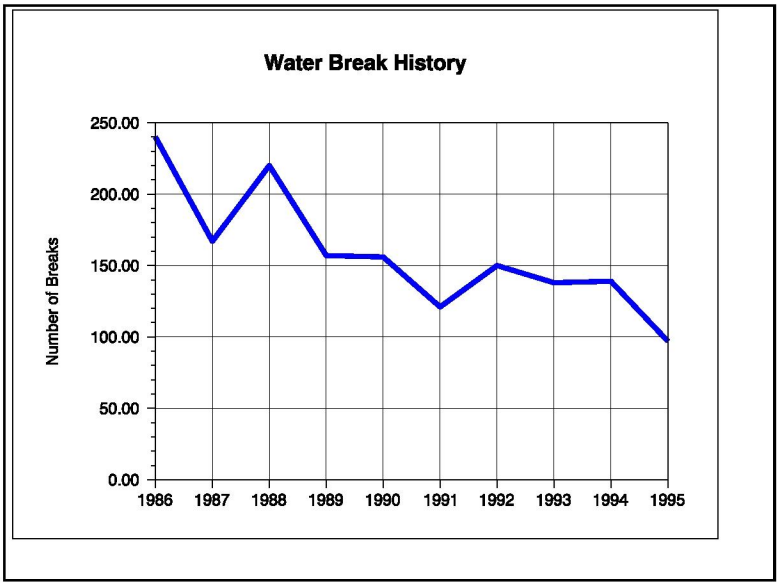
Leak Detection

The City of Grand Junction employs a full time maintenance crew which works 8 hours daily, Monday through Friday, and has staff on call the remaining 16 hours and weekends. This crew responds as soon as possible to all leaks and breaks. Any equipment found to be substandard is replaced through a regular maintenance program. One of the most advantageous aspects of the City's water system is that almost all of the distribution system is located along public rights of way. This allows frequent observation of these areas by people using these areas in addition to normal maintenance checks by the

City's water department.

The City makes every effort to reduce the amount of leakage to 0%. The City has also funded the upgrading and replacement of older, deteriorated water mains. This is possible through the water department capital improvement program. During the 10 year period 1996 - 2005, $10,092,000 is expected to be spent in water system upgrades.

1. The City's water department performs leaks surveys which include pressure drop surveys, the use of geophones, and the investigation of dirty water complaints.
2. The City's maintenance crews respond as soon as possible to reports of actual or detected leaks. They assess each situation individually by making the appropriate shutoffs to isolate the leak and reduce the volume of lost water. They then weight the economic factors of scheduling the repair for normal work hours versus overtime hours. If the leak or break is substantial and would cause a large volume of lost water or create any unsafe situation in comparison to the cost of the repair, they would then repair the break or leak immediately. Otherwise, the repair would be scheduled for normal daytime work hours.



3. The last years efforts were as follows:

Number of leaks detected: 92 watermain breaks

5 service leaks

Number of leaks repaired 97 total

4. The problems associated with the City's current leak detection and system rehabilitation program are the City's current personnel occasionally have difficulty keeping up with the work load when they are busy performing their normal maintenance duties and additional incidence occur which require their attention, such as new construction, water taps, sewer maintenance work, leaks, etc.

5. The City of Grand Junction spends approximately 22% of the Water Department's budget annually on system rehabilitation and leak detection.

6. The financing for capital improvements is allowed through the annual revenues from the sale of water to the City's customers.

7. The long range goals that the City of Grand Junction has for it's leak detection and system repair are as follows:

a. Replacement of older mains in areas of breaks.

b. Contract out for a more advanced leak detection program and pursue a more sophisticated leak survey on a shorter cycle time.

8. The City is incorporating these long range goals into their planning by replacing watermains in bad condition with new and/or larger ones. The City is also eliminating dead ends and looping water mains, where possible. The Water Department crews either perform these installations or advertise them for competitive bidding.

Watershed Management Program

The City of Grand Junction has been involved in a reservoir management group since 1927. This group is formally called the Grand Mesa Reservoir Pool and is made up of all of the owners of reservoirs on Grand Mesa which empty into Kannah Creek.

There are 13 reservoirs in this pool which are used for the purpose of storing irrigation and municipal waters which, during summer months, are discharged into Kannah Creek, as desired and required by owners and users thereof.

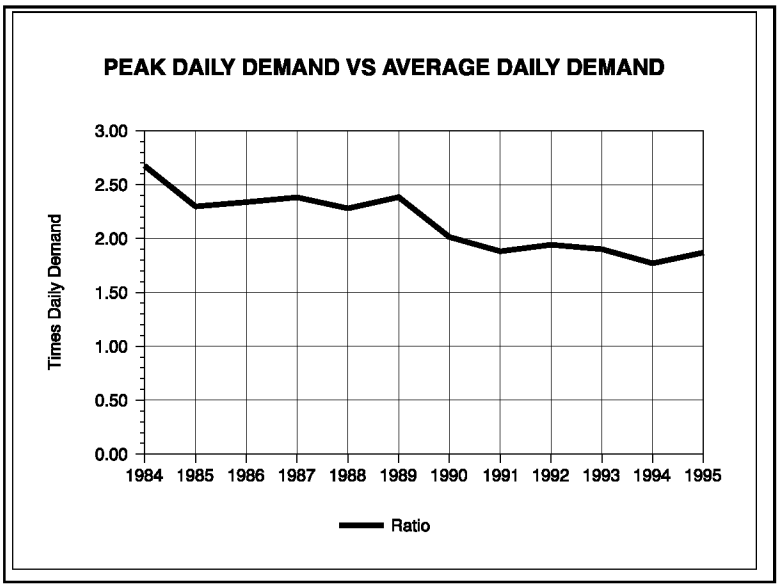
The City representative has been in control of the operation of this pool since the mid 1970's and has operated the reservoirs to maximize water quality along with minimizing evaporation losses. Even though the reservoirs sit at an elevation of roughly 10,000 feet above sea level, they have a potential for substantial evaporation losses due to the shallowness of reservoirs themselves. This shallowness not only leads itself to evaporation losses but also to proliferation of algae growth.

It is for both of these reasons that it is critical to time the releases out of reservoirs to maximize water quality for municipal usage and to minimize evaporation losses to get the most beneficial use from water supply.

Raw Water Management

Grand Junction has always tried to maintain a balance between the economics for the demand side of treated domestic water and capital costs of delivering this water. In the mid 1980's it was apparent that the demand on the treated water system was beginning to overtake the supply side. It was during this time that changes were made that would increase the supply side of treated water system by lessening the burden of supplying treated water to the Lincoln Park Golf course and

municipal cemeteries. In 1986, the municipal cemeteries were converted to a raw water source that is made up of recycled backwash water from water treatment facility. The water still comes from Kannah Creek basin and is a high quality water source, but by converting the cemeteries to raw water it reduced the impact of treating this water and eliminated the potential of certain pathogenic organisms from concentrating and being reintroduced into raw water feed to treatment plant. This change, which involved the installation of one valve and a few feet of pvc water line, reduced the demand on treated water system by 50 million gallons per year and a peak daily demand of up to one half million gallons per day.



The other change made to reduce demand on treated water system was converting Lincoln Park golf course to an untreated raw water source in 1990. A waterline was constructed from golf course to Grand Valley irrigation canal during construction of a sanitary sewer project to help reduce project costs. A lake on the golf course was lined to prevent losses and new pump system designed to maximize pressure and efficiency was installed near lake. This new pump system was tied into sprinkling system for golf course and treated water system was physically disconnected to prevent cross connection with untreated water.

This new system was designed to supply adequate water and pressure for maximum coverage and eliminate the practice of watering

that was more like flood irrigation, than a modern underground sprinkling system. This new system reduced treated water demand by 100 million gallons per year and reduced daily peak demand by as much as 2 million gallons per day.

Residential Retrofit Pilot Program

The Grand Junction Residential Retrofit Pilot Project began in April 1991. The Colorado Office of Water Conservation managed the project with the help of the Grand Junction Utilities Department, the Office of Energy Conservation and area consultants.

Retrofit projects are not new. A few aspects of this project, however, made it unique. The project was designed to include monitoring and evaluation of both water and energy consumption. The project also set out to determine water savings potential and customer satisfaction of more sophisticated retrofit devices. The devices used in this project include the "Future Flush", a dual-flush (two option) device, and the "ShowerSpa" shower head.

Approximately 100 single family homeowners agreed to participate in an 18-month project to help city officials determine water saving potential from plumbing retrofit devices. Homeowners were then provided with 2.0 gallons per minute flow "ShowerSpa" shower heads, faucet aerators and "Future Flush" toilet devices for all bathrooms and sinks. Free plumbing help was provided to homeowners that requested assistance in installing the devices. Water and energy consumption was collected monthly for evaluation. Surveys of participating homeowners were conducted as part of the project. An attempt was made to ensure the pilot project emulated "real life" water use.

The overall goal of the Grand Junction Residential Retrofit Project was to develop information regarding the economic impact of a

retrofit program and the water utility's return on program investment. The project was designed to accomplish this goal through the following objectives:

1. To determine changes in water and energy usage from a residential plumbing fixture retrofit;
2. To determine the program cost effectiveness for both residents and the Grand Junction water utility;
3. To determine long term water savings potential from retrofit;
4. To evaluate device acceptance levels from homeowners.

Energy consumption data was collected for an 18-month period ending in October 1992 while water consumption data continues to be monitored. The original 18-month period included one full winter water-use season which is important to isolate interior water use from exterior use and weather variables.

Based on the results outlined in this report it is difficult to determine the long range savings in energy consumption based on any 18-month time period. Gas and electrical consumption have too many variables that do not correlate across to water consumption. We cannot say for sure if this 18-month data collection period and the previous 24-month baseline period were normal, and all variables within both time periods equivalent. The results of the water consumption data (a decrease in water consumption of 9%-12% during winter months, and overall decease of 4%-8% for the entire retrofit project) shows that the retrofit project does make a significant impact for residents. The impacts for our water utility and more information on this project can be found in APPENDIX 1 and Retrofit Program Summary.

Moderate Plumbing Code

The Mesa County Plumbing Code requires water saving devices for

all new construction. Moderate water saving devices include low flow shower heads using a maximum of 3.0 gallons per minute, low volume flush toilets using 3.5 gallons per flush cycle, low flow faucets using a maximum of 2.75 gallons per minute, and water effecient dishwashers.

Future Additional Water Conservation Measures

Public Education Program (expanded by developing a water festival to include an additional day and the general public)

Advanced Plumbing Code

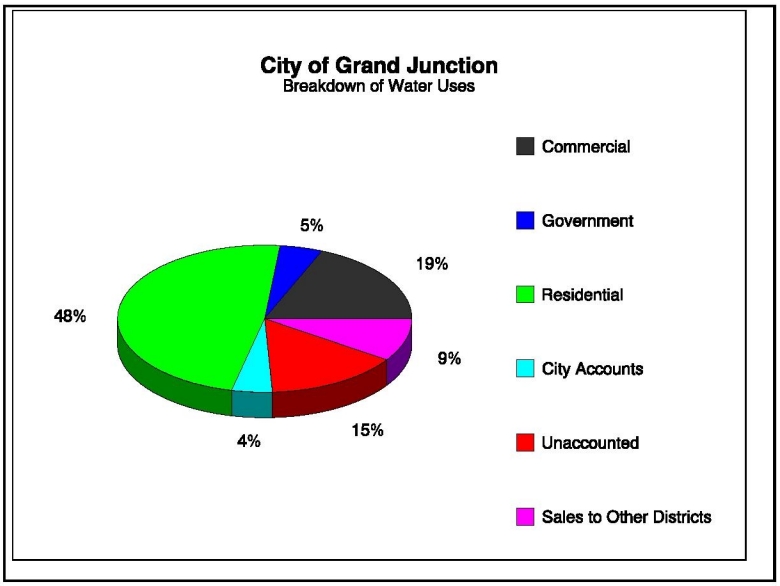
Xeriscape (see Glossary)

Evaluate Current and Emergency Rate Structures

Water Audit Services by Trained Staff

WHERE WE WANT TO BE

City of Grand Junction would like to provide all of the water needed for the uses desired by its customers in a manner that is as efficient as current knowledge and technology will allow, tempered by reasonable cost considerations.



Water use records for 1995 indicate that in the City's service area, residential demand accounts for approximately 48.0% of the City's total annual water demand. Commercial customers demand accounts for 18.7%, Government uses 4.7%, City accounts (parks, buildings,

cemeteries, etc) for 4.4%, and 14.8% is unaccounted-for water. Another 9.4% is sold to other water districts in the valley for their customers benefit.

HOW WE PLAN TO GET THERE

Many strategies and methods are being implemented to accomplish these goals. The water conservation strategies are arranged in the following categories:

- City of Grand Junction Facilities
- Residential: Single-Family
- Residential: Multi-family
- Business/Industrial
- General applicability

Selection of Strategies

Strategies and methods included in this Master Plan have met the following criteria:

1. Can the program be implemented?
    - Are there legal considerations which may affect the program? Does the responsibility for implementing the program fall within City of Grand Junction's jurisdiction?
2. Is the program cost effective in the long run?
    - Do the projected savings justify the cost required to implement it when compared to other options? Would another approach cost less or offer greater savings?
3. Can the success of the program be measured?
    - Does it include a method for determining its success or failure?
4. Will the program result in sustainable water savings?
    - Will the program encourage long-term water conservation?

The City may amend or expanded these criteria as necessary.

CITY OF GRAND JUNCTION FACILITIES

Outdoor

- Develop within three years a xeriscape demonstration in cooperation with an outside agency like the Botanical Society.
- Develop a system that identifies potential service areas that are in need of replacement based upon break and leak frequencies.
- Currently the unaccounted water represents 15%. Expand leak detection program in coordination with meter replacement to reduce unaccounted water to 10%.

Indoor

- Perform water audits by trained City staff to assist city facility management staff to help reduce water demand.
- Encourage replacement of non-conserving toilets with those using 1.6 gallons or less per flush by supporting changes in building codes without offering customer incentives
    - Toilets using 1.6 gallons per flush or less
    - Showerheads using a maximum of 2.5 gpm
    - Kitchen, lavatory, and service faucets having a maximum flow of 2.2 gpm

SINGLE FAMILY RESIDENTIAL

Outdoor

- Investigate realistic incentives for Xeriscape which will have permanent effective results.
- Encourage landscapes for both maximum water efficiency and maximum beauty.

Indoor

- Perform water audits by trained City staff to assist water customers to help reduce water demand.
- Encourage replacement of non-conserving toilets with those using 1.6 gallons or less per flush by supporting changes in building codes without offering customer incentives
    - Toilets using 1.6 gallons per flush or less
    - Showerheads using a maximum of 2.5 gpm
    - Kitchen, lavatory, and service faucets having a maximum flow of 2.2 gpm

MULTI-FAMILY RESIDENTIAL

Outdoor

- Investigate realistic incentives for Xeriscape which will have permanent effective results.
- Encourage landscapes for both maximum water efficiency and maximum beauty.
- Create an Apartment Water Efficiency Program to include analysis of potential conservation in swimming pools and decorative water features.

Indoor

- Perform water audits by trained City staff to assist water

customers to help reduce water demand.

- Encourage replacement of non-conserving toilets with those using 1.6 gallons or less per flush by supporting changes in building codes without offering customer incentives.
    - Toilets using 1.6 gallons per flush or less
    - Showerheads using a maximum of 2.5 gpm
    - Kitchen, lavatory, and service faucets having a maximum flow of 2.2 gpm

BUSINESS AND INSTITUTIONS

Outdoor

- Investigate realistic opportunities for Xeriscape which will have permanent effective results.
- Encourage landscapes for both maximum water efficiency and maximum beauty.

Indoor

- Perform water audits by trained City staff to assist water customers to help reduce water demand.
- Encourage replacement of non-conserving toilets with those using 1.6 gallons or less per flush by supporting changes in building codes without offering customer incentives.
    - Toilets using 1.6 gallons per flush or less
    - Showerheads using a maximum of 2.5 gpm
    - Kitchen, lavatory, and service faucets having a maximum flow of 2.2 gpm

GENERAL APPLICABILITY

Information and Outreach

- Develop strong marketing plans to market water conservation for each of the main customer groups.
- Create and distribute conservation information to elected, appointed and career public officials and their employees.
- Share information with others in conservation related organizations.
- Work closely with other area water providers on conservation plans.
- Distribute conservation information to senior citizens, parks personnel, nurseries, etc.
- Develop and implement a plan for receiving feedback (outreach) from customers.
- Create a collection of conservation information at the Mesa County Library.

Education and Training

- Offer school programs, including tours of water facilities and conservation demonstrations to all teachers and students.
- Offer classes for teachers re-certification credit.

Pricing, Rates, and Billing

- Consider rate structure to encourage wise water use among the highest water users.
- Utilize the City of Grand Junction Newsletter to provide clear water use information and helpful comparisons.

Statutes, Codes, and Regulations

- Review City of Grand Junction Operating Rules for opportunities to specify conservation requirements and amend as necessary.
- Develop "Conservation Guidelines and Standards."
- Promote incorporation of "Conservation Guidelines and Standards" into Resolutions.
- Support implementation of water efficient building codes throughout the City of Grand Junction service area.

Research

- Research areas inefficiency and identify potential for the greatest savings.
- Use published research data when possible.
- Investigate potential uses for untreated (raw) water.
- Make suggestions and contributions for research to the American Water Works Association Research Foundation for conservation research.

HOW WE WILL KNOW WE HAVE SUCCEEDED

Monitoring and Evaluation

Implementing these conservation strategies is, by itself, not enough. Because water saved through these programs has become an important component of future water supply planning, City of Grand Junction needs to know how well these strategies are working, when they should be initiated, intensified or phased out, how they affect customer's lifestyles or businesses, how they affect the human and natural environment, whether they give rise to unforeseen problems, conflicts or legal issues, and whether they are worth their costs.

Monitoring and evaluating the water efficiency gains of diverse customer groups using many conservation strategies is a complex challenge requiring a great deal of information. To be done well, it demands that City of Grand Junction prepare for it in advance and stay ahead of the information flow. To accomplish this, City of Grand

Junction will undertake an ongoing monitoring and evaluation program to:

- Review what each program is expected to contribute to water conservation, that is, its specific goal, including potential reduction of unaccounted-for water.
- Design the methods which will be used to measure and evaluate its progress toward that goal and its costs.
- Define the information necessary for measuring the success and costs of each program and its overall contribution to conservation.
- Gather information in a timely manner.
- Design and maintain functional and durable data bases.
- Analyze periodically the success, cost, and other relevant characteristics of each conservation program.
- Prepare annual reports of progress made, costs incurred, customer participation and response.

AMENDMENTS TO ANNUAL PLANS

Monitoring and Evaluation reports will provide a foundation which City of Grand Junction staff will use to prioritize strategies, to design Annual Action Plans for optimum effect and to improve the monitoring and evaluation process itself. Each Annual Action Plan should include monitoring and evaluation components for each project. They will also indicate how successful City of Grand Junction and its customers are meeting long-term water conservation goals.

ANNUAL CONSERVATION ACTION PLAN PROCESS

1. Implement action item approved for the budget year, continue action items from previous years.
2. Evaluate results and modify objectives for next year, draft next year's annual plan.
3. Design strategies for achieving annual objectives in alignment with Master Plan.

4. Continue to include line items in the budget for implementation of items relevant to the water conservation master plan.
5. Provide copies of approved plan to interested citizens.
6. Monitor ongoing programs.

SUMMARY

Efficient use of water from Kannah Creek, North Fork of Kannah Creek and Whitewater Creek basins will play an increasingly important role in City of Grand Junction's long-range water use planning. Through wise water use, the need for costly facilities may be delayed and water resources may be protected for other uses.

To achieve these goals, it is necessary to get broad-based support for all conservation programs. It is also necessary that efficient water use becomes "second nature" for everyone. Clearly, no one person or agency can implement such changes in water use behavior. Only systematic, gradual behavior changes, interwoven with advances in technology will permanently create water conservation.

Many different strategies will be used to reach these water conservation goals. Present programs target indoor and outdoor water use in both the public and private sectors. It is the intent of this Conservation Master Plan to provide a framework for evaluating and monitoring the various programs, while remaining flexible enough to adapt to changing conditions and to community needs. Sustainability in water savings and the cost effectiveness of the program will be key considerations in assessing various programs. Specific programs will be selected and funded during the annual planning and budgeting process.

Achieving water conservation goals will require the effort and commitment of everyone. The intent of City of Grand Junction is to ensure that future generations enjoy high quality water in sufficient quantities to meet their needs, and to work closely with citizens to build a foundation for tomorrow through efficient water use today.

GLOSSARY

ACRE FEET: A measurement to describe a volume of water. One acre-foot is the amount of water which would cover one acre of land to a depth of one foot: 325,851 gallons.

ACTION PLAN: A more detailed, analytical course of action to implement concepts outlined in a Master Plan, usually set up on a 12-month basis, having staffing and budget allocated to achieve specific objectives.

CONSERVATION: A set of strategies to solve the dilemma of providing water to people, both through supply management (in which the utility maximizes efficient use of water) and through demand management (in which the customers practice efficient use); wise, efficient use by suppliers and customers. (See also demand management and supply management.)

DEMAND MANAGEMENT: Methods to encourage customers to reduce their water demands thus using water efficiently. (See also conservation.) Example: Installation of water-efficient fixtures in bathroom, kitchen and laundry room by the homeowner/property manager.

EVALUATION: The overall determination of a conservation program's effectiveness; strict accountability by a utility to its governing body and to its customers.

GOALS: General statements of purpose for an effort or program; goals should compliment and reinforce other city/District/community goals.

MASTER PLAN: A conceptual framework to show direction of intent.

MISSION/PURPOSE STATEMENT: A statement in clear language which explains why we exist, why we do what we do to ensure a certain standard quality of life for our customers.

MONITORING: An ongoing process to assess results of an effort. Steps in the process include identifying what will be measured, what assumptions will be held, what estimates are agreed on, what measuring tools will be used.

MULTI-FAMILY RESIDENTIAL: A planning term used to describe a building where two or more families live in separate units under one common roof, for example, apartment houses, townhomes, condominiums.

OBJECTIVES: Specific operational aims quantified in an annual action plan; statements must include specifically who will do precisely what, by when, and at what cost.

PROGRAMS: An ongoing effort to achieve a goal, usually involving several projects; e.g., a conservation program may include a metering project, a retrofit project, and a landscape project.

PROJECT: Systemized efforts to achieve an objective.

PROJECTED SAVINGS: An estimate of the amount of water which will be conserved because suppliers and customers are implementing certain efficiency practices.

RETROFIT: An umbrella term which refers to the modification of something. In the case of water conservation, retrofit refers to modifications to plumbing fixtures to increase efficiency.

SUPPLY MANAGEMENT: Methods in which a utility maximizes use of available untreated water. (See also conservation.)

SUSTAINABILITY: A decision-making concept describing development that meets the needs of the present without compromising the ability of future generations to meet their owner needs.

UNACCOUNTED-FOR WATER: A term used to describe the various ways water is difficult or impossible to measure such as under-registration of aging water meters, leaks, fire suppression, and water used in flushing the distribution system through fire hydrants.

XERISCAPE™: A landscape concept to describe a seven-step process of landscaping that conserves water and protects the environment. Developed by Denver Water in 1981, the term is now trademarked by the National Xeriscape Council, Inc. The seven steps are:

1) Page and Design
2) Soil Analyses
3) Appropriate Plant Selection
4) Practical Turf Areas
5) Efficient Irrigation
6) Use of Mulches
7) Appropriate Maintenance

(When this seven-step system is applied, landscape water may be reduced 30-80%.)

APPENDIX 1

CITY OF GRAND JUNCTION RESIDENTIAL RETROFIT PROJECT SUMMARY

The Grand Junction Residential Retrofit Pilot Project began in April 1991. The Colorado Office of Water Conservation managed the project and received technical advice, project implementation and other assistance from sources including Grand Junction Utilities Department, Office of Energy Conservation, Denver Water Department, and area consultants.
Retrofit projects, which change out existing plumbing fixtures and replace them with new lower water usage plumbing fixtures, are not new. A few aspects of this project, however, make it unique. The project was designed to include monitoring and evaluation of both water and energy consumption. The project also set out to determine water savings potential and consumer satisfaction regarding retrofit devices. The devices used in this project include the "Future Flush", and dual-flush (two option) device, the "ShowerSpa" shower head, and swivel faucet aerators.

Approximately 102 single family homeowners agreed to participate in this 18-month project to help city officials determine water saving potentials from plumbing retrofit devices. Homeowners were then provided with a 2.0 gallon per minute flow "ShowerSpa" shower head, a faucet aerator and a "Future Flush" toilet device for all bathroom fixtures and asked to install them. Water and energy consumption was collected monthly for evaluation. Two surveys of participating homeowners were conducted and are a part of the project. An attempt has been made to ensure this pilot project emulates "real life" water use versus water use in a controlled laboratory setting.

PROJECT GOAL

The overall goal of the Grand Junction Residential Retrofit Demonstration Project was to develop information regarding the economic impact of a retrofit program and the water utilities return on program investment. The project was designed to accomplish this goal through the following four objectives:

1. **To determine changes in water and energy usage from a residential plumbing fixture retrofit.**
2. **To determine the program cost effectiveness for both residents and the Grand Junction water utility.**
3. **To determine long term water savings potential from retrofit.**
4. **To evaluate device acceptance levels from homeowners.**

Water consumption data was collected for a 24-month period ending April 1993 and energy consumption data was collected for a period of 18 months ending in October 1992. This period will include one full winter water-use season which is important to isolate interior water use from exterior use and weather variables.

RETROFIT PROJECT RESULTS

The Grand Junction Retrofit Project only officially lasted 18 months. This time frame is probably not adequate to do a comparison between energy consumption and water consumption. The data for energy consumption is affected very dramatically by weather conditions. The original data collection time frame was from May 1991 through October 1992, with all project results being compared to a two year average just prior to installation of retrofit devices. The water consumption data was collected for an extra six month period, for a total data

collection period from May 1992 through April 1993. This extended data collection period for water consumption will show a more accurate trend towards savings, because it covers two winter seasons, when water savings potentials are more accurately measured.

As in any real life project, this project had many variables to consider. The number of total participants was reduced from 102 to 85. The reduction was primarily due to ownership changes or other situations which were not acceptable for evaluation.

Gas Results

Gas consumption was evaluated for the 18-month project period from May 1991 through October 1992. Winter consumption was also analyzed separately, this being from November through February. Gas consumption shows an increase of gas use for November and December, with a decrease in gas consumption by 0.87%. The retrofit devices resulted in overall savings in gas consumption of 6.85% for retrofit homeowners during the 18-month period.

Electricity Results

Electrical consumption was evaluated for the 18-month project period from May 1991 through October 1992. Winter consumption was also analyzed separately, this being from November through February. Electrical consumption shows an increase for electricity for November and December, with a decrease for January and February. These four months represent a decrease in electrical consumption by 0.55%. The retrofit devices resulted in overall savings in electrical consumption of 0.54% for retrofit homeowners during the 18-month period.

Water Results

The results of the water savings are going to be broken down into three different sections. The first section will include the same 85 customer base that was used in the gas and electricity results for means of comparisons for this retrofit project. The second section will give water consumption data for all 102 customers that were initially involved in the retrofit project. The third section screens the original 102 customers for missing data for water consumption only, and extends the monitoring time from 18 months to 24 months to obtain data through the two winter seasons.

This first section shows water consumption for the same 85 customer base which was evaluated for the 18-month project period from May 1991 through October 1992. Winter consumption was also analyzed separately, this being from November through February. Water consumption data shows a decrease in water consumption for all four winter months. Reduced water consumption for winter use resulted in a savings of 9.35%. The use of the retrofit devices reduced water consumption by 4.03%.

Water consumption for all 102 customers was evaluated for the 18-month project period from May 1991 through October 1992. Winter consumption was also analyzed separately, this being from November through February. Water consumption data shows a decrease in water consumption for all four winter months. Reduced water consumption for winter use resulted in a savings of 12.33%. The overall reduction in water consumption for the 18-month project was 6.45%.

The 17 customers that was screened out from the original 102 customer base, reduced their winter water consumption by 20.48% and for the entire 18-month project by 18.91%.

This last section will deal with a customer base that will be used for long range planning and future water conservation programs. This customer base started with the original 102 customer base, which were then rescreened based on available water consumption data only and answers on the final questionnaire. Of the 13 customers screened

out, some were eliminated because they never installed the devices or never received the devices, others did not have enough prior water consumption data to make a comparison after retrofits were installed. The remaining 89 customers were evaluated for a 24-month period from May 1991 through April 1993. Winter consumption was also analyzed separately, this being from November through February for two winter cycles. Water consumption data shows a decrease in water consumption for the months of November, January and February, with December having the same consumption. Reduced water consumption for winter use resulted in a savings of 10.32%. The overall savings for the 24-month period was 8.40%.

FINAL SUMMARY

The retrofit projects main goal was to develop information regarding the economic impact of a retrofit program and the water utilities return on program investment. The following four objectives were established to help accomplish this goal.

The first objective was **to determine changes in water and energy usage from a residential plumbing fixture retrofit program.**

Based on the results outlined in this report it is difficult to determine the long range savings in energy consumption based on any 18-month time period. Gas and electrical consumption have too many variables that do not correlate across to water consumption. We cannot say for sure if this 18-month data collection period and the previous 24-month baseline period were normal, and all variables within both time periods equivalent. The results of the water consumption data (a decrease in water consumption of 9%-12% during winter months, and overall decease of 4%-8% for the entire retrofit project) shows that the retrofit project does make a significant impact for residents.

The second objective was **to determine program cost effectiveness for both residents and the Grand Junction water utility.**

Since this project furnished all devices free of charge to retrofit participants, its cost effectiveness to residents couldn't get any better. If participants are required to purchase their own retrofit devices, the payback for each customer will vary according to actual water and energy savings, it should take from 15 to 18 months to recover their initial investment of approximately $60 for all three types of retrofit devices.

As a utility, the answers get much more complicated. Based on the results of this retrofit project, a City wide retrofit program would save approximately 100 million gallons of water per year, or enough water to serve approximately 1,500 new residents. Operating costs at the water treatment plant would also be reduced by $6,000 per year. If new residents are not there to use this available water, we would be forced to increase water rates by 5%, to make up approximately $175,000 in lost revenue. Also, if we were to furnish these same devices to all homeowners, we would have to increase water rates an additional 3%, for a 10-year period, to pay for capital outlay for retrofit devices.

On the other side of the picture, if we needed to develop additional water resources for an expanding customer base, this type of water conservation program through the use of retrofit devices would be very attractive. The cost per acre foot of developed water would be $2,100. This is higher than the $1,200 - $1,500 we would

like to pay, but much less that the $6,000 per acre foot, some other projects are expecting to cost, once developed.

The third objective was **to determine long term water savings potentials from retrofit.**

As stated in the second objective, we could achieve long term savings of 100 million gallons of water per year from the installation of retrofit devices, which is equivalent to 4.5% of total water used in our system. By comparison, as stated in a March 1989 AWWA Journal report titled "Long Term Options for Municipal Water Conservation," conversion to an increasing block rate (the rate for each additional 1,000 gallons of water used increases) for water rates could save up to 10%, or an increase in water rates of 10% could save 3% of total water consumption.

We will continue to monitor these customers (89 customer base) for a few more years to determine if water consumption savings will continue at the same rates as in the past 24-month period.

The final objective was **to evaluate device acceptance levels from homeowners.**

The devices used in this retrofit project were of high quality which contributed to the acceptance levels also being high. The lowest rated and most troublesome device was the "Future Flush" dual flush toilet device that required an occasional adjustment. Even though it was the lowest rated, almost 75% of the respondents stated they will continue to use the "Future Flush" device after the retrofit project is over. Approximately 98% of respondents indicated they will continue to use the "ShowerSpa" shower head.

The Grand Junction Retrofit Project answered all the objectives it started out with. The results pertaining to energy consumption leave room for debate about true energy reductions versus water reductions. Unless hot water heaters were individually measured for energy consumption during retrofit project, data collection on energy consumption could take five to ten years before enough data was obtained that true averages could be derived.